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SCIENCE AND METAPHYSICS

BY

JOHN RUSSELL, S.J.

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Introduction

THERE has always been a certain tension between the natural sciences and metaphysics. They represent two quite distinct methods of investigating reality, approaching their subject-matter from widely different points of view, using widely different methods and reaching very different conclusions. It is difficult for the scientist to understand precisely what the metaphysician is claiming to do, and vice versa. The scientist tends to dismiss the work of the metaphysician as meaningless word-spinning and the metaphysician to regard the scientist's activity as trivial or as mere technology, his reasoning as jejune, his conclusions as having, no doubt, a certain pragmatic value, but as being hardly worthy of the attention of a genuine seeker after wisdom.

The relative value attached to the two disciplines by educated people has varied greatly from one epoch to another throughout the history of European civilization. During the thirteenth century, for instance, metaphysics was ranked as much

the higher of the two, but since then it has gradually sunk in common estimation while natural science has risen. At the present time natural science is generally regarded as a vigorous, successful and highly important method of discovering such truth as can be attained about the real world, while metaphysics is a very poor relation, having great difficulty in establishing a claim to say anything significant at all. This change in status is reflected in a corresponding change in the meaning of the term "science." During the Middle Ages, theology and philosophy were regarded as sciences in the fullest sense. Nowadays the term has become almost exclusively appropriated to the physical and biological sciences, with the implication that these are the only sources of genuine intellectual knowledge about the world.[1] For many modern philosophers and scientists, "metaphysician" is little more than a term of abuse, metaphysics is either mere nonsense—the symptom of a mental or linguistic confusion which can be straightened out by the logician and the scientist working in cooperation—or, at the best, a rag-tag of obsolete scientific theories which have been inadvertently canonized as self-evident truths. And indeed it must be admitted that a superficial comparison be-

[1] We shall conform to the modern usage as a matter of convenience, but without in any way accepting the implication in question.

tween the respective achievements of science and metaphysics gives at least a prima facie ground for the very unfavourable judgement passed upon the latter.

1. Science and Metaphysics: A Preliminary Comparison

SCIENCE is genuinely progressive. The body of reliable scientific knowledge increases steadily from one period to another. The scientist who comes later in time is able to start from the point where his predecessors left off, and to add something definite. This is not to say that scientific theories remain unshaken from one century to the next. On the contrary, they are always liable to be replaced by others. But this does not represent a dead loss of the previous work. Whenever one theory is superseded by a newer, the newer normally seems to mark a genuine advance over the older. Moreover, the work—the observation and reasoning—which went to the construction of the older theory is not wasted; to a greater or less extent it is incorporated in the new, and receives in it a fuller and more satisfactory interpretation. The scientist can feel, with full justification, that our scientific understanding of the physical universe is continually increasing and that his own work, if honestly and conscientiously performed, is adding

to the corpus of scientific knowledge, even though his own particular theories may be, and probably soon will be, superseded.

Closely connected with the previous point is the fact that scientific knowledge can in principle, and to a large extent does in practice, command universal assent from those who are willing to make a study of the evidence. Particular theories will be open to dispute, but at least the basic facts on which they are constructed will normally be agreed upon.

Moreover, scientific theories are subject to rather strict external control. Any properly constructed scientific theory will not only cover the facts already observed; it will also predict the occurrence of a whole range of events not yet observed. If these predictions are falsified by the event, the theory must be modified or abandoned. It can only qualify as acceptable so long as its predictions are regularly fulfilled. An objective and very powerful criterion is thus available for weeding out defective theories, and this imposes a strict limitation on the possible range of scientific speculation.

Metaphysics, on the other hand, compares unfavourably with science on all these counts. It has no record of steady progress; it seems incapable of securing anything like universal agreement even on the simplest questions, and it can produce no

compelling or generally acceptable criterion for eliminating false theories. Whether we consider ancient Greece or (to a lesser extent) the Middle Ages or, more particularly, the modern period from the seventeenth century onwards, we find a continuous disagreement between different metaphysical schools on the most fundamental points, with no signs of any tendency towards a *rapprochement.* During the past four hundred years the history of metaphysics, outside the scholastic tradition, has been that of a continuous succession of diverse and mutually incompatible systems, each of which has been put forward as the final solution of all metaphysical problems, and has then failed to fulfil the hopes that had been entertained of it. And if scholastic philosophy has preserved throughout a relative stability and unanimity, the hostile critic may be disposed to explain this on the grounds that it is not a genuine philosophy but a "party line" imposed from above by ecclesiastical authority for the defence of Catholic dogma.

At the present time the system-builders seem to have become discouraged; there is a general disposition to admit that metaphysics is a waste of time and that it cannot lead to any conclusions having real value. In order to see how this situation has come about, it will be necessary to consider in more detail the difference between the methods of science and metaphysics. We may then

be in a better position to decide whether there is a place for metaphysics in the modern world. Is the metaphysician tackling genuine problems which lie outside the scope of natural science and, if so, has he any prospect of solving them, or at least of investigating them profitably?

coloured by the view—implicit or explicit—which one takes of the nature of personal identity. If I make a promise, am I bound to fulfil it? May I argue: "The being who made the promise was distinct from the one who is now called upon to fulfil it. Why should I consider myself bound by the acts of my predecessor? I was a different person when I made it, from what I am now"? A weakening of the sense of enduring personal identity may well produce a weakening of the sense of personal responsibility, with corresponding repercussions on personal conduct.

From a more theoretical point of view, the question is important in modern logic. The ideal logic of science, as has already been noted, is a logic of univocal terms. The driving force of a great deal of modern philosophy—for instance that of Russell, Wittgenstein and the logical positivists—seems to have been an endeavour to extend this logical *schema* to cover all aspects of the world. A logic of univocal terms, if consistently applied, must necessarily lead either to monism or logical atomism. Hence, if it is true that some of the fundamental terms of rational discourse are irreducibly analogous, it is clear that the attempt to limit philosophy to univocal terms will necessarily lead to error. We distort our view of the world when we try to force upon it a logical *schema* which does not apply.

without, it would seem, any possibility of error, (a) that I am in some real sense the same person at different times, (b) that this sense is not that of absolute logical identity and (c) that the being which existed five minutes ago has not been merely replaced by a similar but distinct being here and now. The view that each one of us is actually no more than a succession of "momentary men," [1] each replacing its predecessor for a moment and then in turn being replaced by another, cannot do justice to the directly-given continuity of our experience.

Hence we cannot say, simply and without qualification, that C_0 and C_5 are identically the same, or that they are distinct but similar. They are the same, in some sense of the word which is weaker than absolute identity but stronger than mere similarity plus spatio-temporal connexion. The term "same" is therefore analogous in its applications, and it is necessary that the nature of the analogy should be carefully examined. This is a problem for the metaphysician. It lies outside the scope of natural science; it cannot be clarified by making more accurate measurements on the chalk, nor by examining it through a more powerful microscope. And yet it is not without importance. One's whole attitude to life may well be deeply

[1] Bertrand Russell's phrase; cf. *Mysticism and Logic*, ch. 7.

have tended to this view, notably Wittgenstein (at least in his earlier days) and Bertrand Russell, but it also is attended with difficulties. How many distinct things are we to reckon between 10.0 and 10.5, and how long does each last for? If we assume a finite number of things each lasting for a finite time, then the same question arises in respect to each of the intermediates, C_x: is it, while it lasts, identically the same at each moment of its duration, or in what other sense is it the same? The problem is precisely the same whether each particular thing is supposed to last for a long or a short time. Logically, we should be driven to say that at each instant there is a distinct thing—not the same as the thing existing at any other instant. But this again raises difficulties. What meaning can be attached to the idea of a thing existing *at* an instant only? Such a being would come into existence and go out of existence strictly simultaneously. At one and the same instant it would be both existing and not existing. We could not even say that it would exist at one instant and cease to exist at the next, since any two instants, to be distinct, must be separated by a finite interval however small, and during this interval the whole problem will arise again.

Monism and pluralism seem also to be excluded by our consciousness of our own continuing identity. When I reflect on my experience I recognize,

qualified sense. Any supposed reasons to the contrary are based upon illusion and are wholly unreal. If we call the chalk at 10.0 C_0, and at 10.5 C_5, then C_0 and C_5 are simply identical. This, essentially, seems to have been the answer given by Parmenides among the Greek philosophers and, in one form or another, by philosophical pantheists such as Spinoza and many of the Indian philosophers. It is not, however, satisfactory. If the referend of one term (i.e., the thing or situation referred to by the term), is absolutely identical with that of another term, then it is impossible that the one referend should exist although the other does not. In this sense, C_0 is identically the same as C_0, but is clearly not identical with C_5, since it is conceivable that C_0 might have existed and C_5 not (e.g., if the chalk had been destroyed or annihilated in the interval). When the mind can clearly conceive that the referend of one term might exist, while that of another might not, then there must be some ground of distinction between the two. In some sense, therefore, C_0 and C_5 are distinguishable from each other.

(2) Strict Pluralism, or logical atomism. This goes to the other extreme. C_0 and C_5 are simply, ultimately and irreducibly distinct. They are similar to each other and they are linked by a more or less continuous series of intermediates, but they are distinct things. Many modern philosophers

Let us return for a moment to the piece of chalk which we left earlier in the hands of the scientist. It poses some interesting problems for the metaphysician also. Consider a particular piece of chalk which existed at ten o'clock this morning, and also at five minues past ten. We say it was the *same* piece at each time. What do we mean by this? For the purpose of argument we suppose that during the interval it has suffered no addition or subtraction of material, and no qualitative change of any sort; or at least we prescind from any such changes. Under these conditions the ordinary man, and for that matter the scientist also, will apply the term "same" quite happily without troubling to stop and analyze it. However, it raises problems which it is the business of the metaphysician to examine.

In what sense is it the same piece at the two different times? Two extreme answers can be suggested, and these lie at the foundations of two important types of philosophical system:

(1) Strict Monism: The chalk remains identically the same thing, in an absolute and un-

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genuine field of study distinct from that of the scientist, and second, that there may be something to be said for his conclusions. For a more detailed study of the subject, the reader is referred to the Bibliography on pp. 79-80.

try to base his laws exclusively upon the "ideal" operations of counting and the observation of spatio-temporal coincidences. He will therefore tend, *qua* scientist, to ignore all those aspects of the world which cannot be adequately named by univocal terms, or measured by the ideal operations. He confines himself to one very limited, although very important, aspect of the world. This is legitimate provided that he, or his interpreters, do not make the mistake of supposing that his terms and his methods are the only available road to true knowledge. The artist, the moralist, the metaphysician and the theologian also have their own valid methods of reaching truth, which cannot be reduced to those of the scientist. In the following section we shall consider the approach of the metaphysician.

Before we begin, however, it should be understood that no attempt will be made to give a complete course of potted metaphysics. We shall try to suggest the sort of problem with which the metaphysician deals, and the sort of conclusions which he reaches. The indications which will be given as to how the conclusions are reached will necessarily be too brief to be satisfying to anyone who has not already acquired some familiarity with philosophical reasoning. It will be enough if we can establish, first, that the metaphysician has a

cept of "yellow-as-yellow," rather than that of "yellow-as-wavelength." But these laws are inherently limited in their scope; they can never achieve the status of a law based exclusively on spatio-temporal coincidence and counting.

The fact that the concept of colour is less useful to the physicist than that of wavelength does not in any way imply that it is less important. For the ordinary man colour is very important, for the artist still more so. And there are no good grounds for supposing that it is less "real" than wavelength or, for that matter, than spatio-temporal coincidence.

Finally, it should be noted that the requirement of univocity applies only to the terms of a scientific *law*. Scientific theories regularly make use of analogical concepts, though in a different way from that in which (as we shall see later) the metaphysician does so. It is, however, the law rather than the theory which primarily determines the scope and character of natural science. Analogy therefore plays only a secondary role.

We may summarize our conclusions concerning the nature of science as follows: Science has a tendency to seek laws having the greatest possible precision and universality. This requires that the scientist should use terms which are, as far as possible, strictly univocal and capable of exact specification. This in turn requires that he should

ber, according to some agreed system of units, and this number constitutes a precise univocal designation.

(3) Wavelengths can be correlated with other measurable properties of matter in a way in which colours, as such, cannot. Hence they can be incorporated into scientific laws of the widest possible scope. For instance, the atomic physicist, investigating the structure of the sodium atom, can make no use of the fact that heated sodium vapour emits light that looks yellow, but he can make a great deal of the fact that it can be analyzed into various components, each with its own definite wavelength. He may sometimes use colour terms as a matter of convenience, but they are redefined in terms of wavelength. The yellowness of yellow is of no interest to him.

What is true of colour is true of other perceptual phenomena: hardness, hotness, figure (i.e., perceptual shape), sweetness, smoothness, etc. All are lacking in the qualities of precision and universality which alone can qualify an entity for incorporation in an ideal scientific law. It does not follow, however, that they have no place at all in science. Often enough they may function as univocal concepts within a particular field. The experimental psychologist can formulate certain genuinely scientific laws using, for instance, the con-

We might try to eliminate these difficulties by giving every distinguishable shade its own proper name—yellow-A, yellow-B, etc.—but this would be cumbersome in the extreme, and the terms would still not be univocal since:

(3) Two different instances of a particular shade of colour might have different physical properties if each were analyzed in a spectroscope. One might be monochromatic and the other a mixture of several different colours.

However, the spectroscope provides a means of eliminating colour terms such as "yellow" or "yellow-A" from physics and substituting for them the more useful concept of "wavelength." Every occurring colour is characterized by a single, specific, accurately measurable wavelength (if it is monochromatic), or by a set of wavelengths (if it is polychromatic), and these lengths will represent certain aspects of the physical behaviour of the light with precision and universality.

Scientifically, the replacement of colour terms by wavelengths has many advantages:

(1) Wavelengths are determined by the measurement of lengths and angles, both of which involve only the two "ideal" scientific operations already mentioned: counting and the determination of spatio-temporal coincidences.

(2) Every wavelength can be assigned a num-

obtained, which, by virtue of its constant and universal relationships to certain other pure substances, can be given a more precise systematic name—Calcium Carbonate—and the symbolic formula $CaCO_3$. As the standards of scientific precision become more exacting, even this name and symbol are found to be incompletely univocal; for certain purposes it is now necessary to distinguish different varieties of calcium carbonate, symbolized by formulae such as $Ca^{40}C^{12}O_3^{16}$, $Ca^{42}C^{13}O_3^{18}$ etc.[1]

Similar problems arise in the designation of properties. An everyday property-word such as "yellow" will fail to qualify as a good scientific term on several counts.

(1) It covers a whole range of different shades of colour. There is, therefore, always the possibility that some scientific law might be true of one shade of yellow but not of another.

(2) The range cannot be sharply defined. Yellow grades continuously into orange in one direction, brown in another, green in another, and there is no universal agreement as to where precisely the transition occurs.

[1] The term "calcium," as applied to Ca^{40} and Ca^{42}, would normally be called generic rather than analogical, but the distinction is irrelevant to the present argument. Generic resemblance can be regarded as a special case of analogical resemblance.

a good scientific law. Such a law must contain universally valid statements expressed in some definite logical form such as "S. is always P." (I am not suggesting that all or most scientific laws are actually couched in this particular form.) Now if S. has several different meanings, even if these have a certain similarity to each other, such general laws will be impossible. It will always be necessary to add qualifications: S. is P. if by S. you mean S_1, but not if you mean S_2. Hence it will be impossible to devise any set of precise mathematical, logical and syntactical rules for operating with the concepts—for comparing, correlating and quantifying them, and bringing them within the scope of universally valid scientific laws.

The terms used to designate objects in everyday life are seldom univocal in the strict sense required by the scientist. Consider, for instance, a proposition such as "Chalk dissolves in vinegar." This will be true of "pure precipitated chalk" bought in a chemist's shop; it will be only partially true of a piece of chalk dug up from the Sussex Downs, and hardly true at all of a piece of schoolroom "chalk." The scientist therefore has no use for a vague everyday word such as "chalk." Starting from common or garden chalk, he must find some way of isolating a "pure substance" from it, i.e., a material which will have the same properties always and everywhere. Such a substance can in fact be

taste or smell. Others are so little suited to the type of operation which the scientist employs, that he is constrained, in his professional capacity, to ignore them altogether: e.g., comparisons of the relative beauty of different objects, the relative goodness of different acts, and so on. It does not follow that because these are unsuited for incorporation in a scientific law, they are therefore non-existent or unimportant.

One requirement for a good scientific law must be particularly noted, owing to its relevance for distinguishing between the methods of science and metaphysics: all the terms used in the formulation of the law should be, as far as possible, univocal. A term is said to be univocal if its meaning is precisely the same in each of its applications. It is equivocal if it has two meanings which are quite distinct from each other. It is analogical if it has two meanings which are not precisely the same, but which have some aspect of similarity by virtue of which the same word is used for each. Examples of (a) univocal, (b) equivocal, (c) analogical uses of a term would be respectively:

(a) A fast car; a fast train.
(b) A fast car; the Lenten fast.
(c) A fast dye; a fast friendship.

The importance of using univocal terms in science is obvious if we consider again the criteria of

producibility, as to which division of the scale coincides most nearly with one end of the line, and which with the other. They will also agree as to how many scale divisions lie between the end points of the line, and they can agree to call this number the length of the line, expressed in terms of the units in which the scale is graduated. Similarly, if two events occur at a given place, there will be general agreement as to how many beats of a particular pendulum, situated at that place, occurred between the one event and the other. This number can be called the time interval between the events. Precise measurements of angle, weight, etc., make use of similar operations in their respective ways. It is found by experience that observations of these two kinds, performed with all possible degrees of elaboration, are particularly suitable for revealing elements of order between phenomena.

There are of course many other comparisons between phenomena which might be made, but which are less important to the scientist, either because they cannot be made with such a high degree of precision, or because they are of more restricted value in revealing elements of order, or are less susceptible of universal agreement. Some of these are used to a limited extent for particular purposes—e.g., comparisons of colour or intensity of illumination, of pitch or intensity of sound, of

(4) It should be exact. It should say exactly how things will behave under exactly defined conditions; exactly what property P. is possessed by exactly what type of S., etc. Or, if absolute precision is of its nature unobtainable, the law must be able to give a specification of the probable limits of error or uncertainty, with as much precision as the circumstances allow.

(5) It should have the widest possible scope. A law which covers a wide field is to be preferred to one which covers a more limited range of phenomena within that field.

These are ideal requirements which cannot adequately be fulfilled in the early stages of a science, and are probably not to be perfectly attained in any law. But as science advances, its laws will conform progressively more closely to the ideal specification.

There are many different types of observation available to the scientist, but it happens that two are particularly suited to his requirements. These are (a) visual observation of the spatio-temporal coincidence of two small objects; (b) observation of the number of discrete objects in a clearly delimited group. Thus, if a graduated ruler is placed alongside a straight line drawn on a piece of paper with a fine pen, then provided certain elementary conditions are fulfilled, all observers will agree, with a relatively high degree of accuracy and re-

entities, such as fields of force, which are not directly observed in the ordinary sense, but which can be regarded as producing observable effects.

(2) It must be "public," in the sense that different people, observing under similar conditions, will agree substantially in their account of it.

(3) It must be universal: i.e., it must be manifested at all times and all places, provided that the specified conditions are fulfilled.

The scientist formulates this order in a scientific law which, ideally, should conform to the following criteria:

(1) It should be simple and economical. It should introduce no redundant or unnecessary terms, but should express the order in the simplest manner consistent with the requirements of precision and universality.

(2) It should be verifiable by observation. It should be formulated in such a way that it makes specific predictions about events which have not yet been observed, or at least are not yet known to the propounder of the law. If the predictions are fulfilled the law is, to that extent, confirmed; if they are not, it is shewn to be inadequate or false.

(3) It should be universally valid. If, for instance, it asserts that a particular type of object S. has a particular property P. under specified conditions, then always and everywhere where the conditions are fulfilled, it must be true that S. has P.

difficulty is that we cannot know precisely what sort of order we are looking for until we have found it, and until we have found it we cannot know precisely what method will best enable us to do so. This is presumably the reason why attempts to define scientific method, whether by philosophers or scientists, have usually been so inept. However, the logical difficulty arises only when we try to define the two notions with absolute precision. In practice, each can be described with reasonable accuracy, provided that a certain penumbra of unresolved obscurity is allowed to remain.

With these considerations in mind, we may now attempt a very summary discussion of the nature of the scientist's activities. In general it can be said that science deals with those aspects of the order of the world which have the following characteristics:

(1) The order must be observable—at least in principle. It must be an order manifested by phenomena, expressed in terms of relations of similarity, or constant association between diverse observable entities, or in the more complex units of a mathematical formula. It is not necessary that all the terms used in a scientific law should refer to directly observable entities, but they must all be related more or less closely to observation. It is legitimate to postulate or infer the existence of

the nature of the order to be investigated had been discerned, there could be no realization of the method which would best reveal it. Hence the early development of science was necessarily a slow and fumbling business in which empirical technology, isolated discoveries and uncontrolled speculation gradually interacted to produce an appreciation of what there was to be discovered and the way in which it could be discovered. Once this realization had come, further progress was rapid. Every improvement in method led to a further appreciation of the order, and this in turn suggested further developments of the method.

What then are scientific order and scientific method? In a general way it can be said that scientific method is a particular way of operating on the physical world. The operations are partly physical—observation and experiment—and partly mental—the selection of suitable data, the recognition of logical or mathematical relations to which they conform, and the elaboration of a logical *schema* or set of rules which imposes a certain structural form upon all propositions within the science. If we wish to give a more detailed definition it is difficult, even today, to avoid some circularity: scientific order is the sort of order which is revealed by the use of scientific method; scientific method is the method which is found to be effective in discovering scientific order. The

THE EARLIER human enquirers were neither scientists nor metaphysicians in the strict sense, since there was no recognition of any diversity of function between the two. They were looking for elements of order in the universe, for concepts which would help them to understand, explain or control the physical things which they observed, but they had no clearly defined method of doing so. Gradually, however, more specialized methods of approach began to crystallize out. Specifically, it came to be recognized that there was in the physical world a type of universal order whose discovery and contemplation had its own special interest and practical importance, and a particular method of investigation which was especially well adapted to revealing this order. The order in question was that which is formulated in scientific laws, and the method was the scientific method.

This recognition was slow in coming, owing to the initial difficulty that until the method had been developed, the extent and importance of the order could not be appreciated; on the other hand, until

3. Human Knowledge: The Scientific Approach

take them as far as they can possibly be taken with any hope of obtaining interesting or profitable results. We shall consider first the approach of the scientist to the problem, then that of the metaphysician. We shall hope to show that each has his own legitimate and distinctive method, and that each has something valuable to say.

Other instances of its occurrence can then be recognized, and these can all be subsumed into a single class. Different concepts can have different degrees of abstractness; the concept of colour is more abstract than that of red, and of property more than that of colour. Recognition of similarity is not, of course, based solely on the immediate appearances of things; we can also classify them according to their characteristic modes of behaviour or their relatively complex interrelations with other things. The process is essentially one of discovering elements of unity and order in the physical world. If the world were a mere heterogeneous chaos in which no one thing remained identifiably the same from one moment to the next, and no two things had any resemblance to each other either in their appearance or their behaviour, then the mental operations in question could have no fruitful result, and any sort of rational activity would be impossible. In fact, this world is not a chaos; the operations can be and are usefully performed by human beings in every stage of their development.

However, at a pre-scientific and pre-metaphysical level these operations tend to be unreflective and haphazard. They are carried far enough for the immediate purposes of practical daily life but not much further. It is the business of the scientist and the metaphysician to carry them further—to

of preserving an enduring identity. Some of these things are given an individual name: John Smith, London, the sun, etc.

(2) We classify these things into groups such that the members of each group can be designated by a common name—man, dog, cat, tree, chair, etc. These groups can themselves be subsumed into wider ones in various ways: dogs and cats can be grouped together as pets, or as animals, etc.

(3) We distinguish further between things and their properties. A piece of wood can be hard and warm and white, but it does not cease thereby to be a single thing; it is one thing with a number of different properties.

(4) Properties, like things, are classified into groups. Pillar-boxes and hawthorn berries, although not in general the same sort of thing, are recognized as having, each of them, a property to which the same name can be given: each of them can be called red. Wider classifications are possible here also: red and yellow can each be called a colour; round and square are shapes, etc.

The classification is effected by a process of abstraction. Two things are mentally compared, and some aspect of similarity between the two is recognized; for instance, each is a chair or each is red. The mind isolates this aspect by a process of intellectual abstraction and forms a general concept of it, by virtue of which it can be given a name.

ALL HUMAN knowledge, whether scientific or metaphysical, must take as its starting point the data of sense-perception. Every human being depends upon his sense experience to provide the material upon which his mind can operate. It is the foundation on which his knowledge is built, even though his knowledge is not restricted to immediate sense experience.

At the most primitive psychological level, the world may be regarded as a confused, variegated, kaleidoscopic field of unanalyzed "experience," consisting of colours, shapes, sounds, feelings, etc., presented as a mere jumble of phenomena. Whether in fact human beings are ever wholly in this condition need not concern us now; certainly we cannot remain in it for long. Almost at once the mind starts operating on the field in a number of different ways:

(1) We divide the field (mentally) into a number of discrete "things" each of which is recognized as being distinct from others and capable

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HESSE, M. B., *Science and the Human Imagination* (SCM Press, 1954).

MASCALL, E. L., *Christian Theology and Natural Science*

aspects of creation reveal God's being in different incomplete ways. God's unity is reflected in one way by logical identity, in another by the continuing personal identity of human beings, in another by the resemblance of one thing to other things, in another by the mathematical unity and simplicity of a scientific law. Every conceivable aspect of the world is grounded in God's nature and manifests that nature in its own way. And since God's nature is one and simple, with no real distinction of parts, it follows that there must be a fundamental unity and similarity underlying the diversity of created things. It is this which is the ultimate ground of the analogy of being. It would seem to be a fundamental and inescapable feature of this world and, indeed, of any conceivable universe created by God.

will ever command the relatively universal assent which is given to many scientific propositions. Hence also the scandal of a multiplicity of metaphysical systems, each claiming its own "insight" into the structure of the world, and each contradicting the others. It does not follow, however, that metaphysics is impossible; only that it is difficult. At the moment uncontrolled metaphysical speculation is on the decline, and there is perhaps a hope that in future some sort of agreed method and terms of reference may be devised for this study as they have been for science.

Finally, one might ask why analogical terms should have such a profound and universal importance. Why should not the world have been built out of elements which were intelligible in univocal terms? Perhaps no definitive answer can be given to this question, but at least we can discern the general outlines of an explanation if we accept the principle that God exists and that all other things were created by Him. For, if the world was created by God, then it is, in a certain sense, a finite manifestation or communication of His infinite perfection. It is reasonable then to conclude that different created things, or different aspects of creation, should show forth this perfection in different ways. Because God is infinite, it is impossible that any creature should show Him forth perfectly or adequately. Hence different

the difficulties of metaphysics is indeed that the relevant data are too familiar. We use metaphysical terms so freely and naturally in ordinary life that we find it difficult to realize that they present any problem. It is surprising how many even educated people think that metaphysical problems can be solved by taking one swift glance at them, and then coming down dogmatically on one side or the other. Our natural tendency is to understand the significance of a word just sufficiently to enable us to use it effectively in ordinary social intercourse, without asking ourselves why the same word is aptly applied in a number of different contexts where its meaning is certainly not univocal. We tend to suppose that if we know how to use a word we know precisely what it means; and this view has undoubtedly been encouraged by some modern philosophers.

In fact this is not the case. A relatively confused recognition of the various fields of application of the word "same" will enable us to use it correctly, but it requires a considerable effort of intellectual discipline and detachment to see precisely why one and the same term should be suitable in each; to identify the grounds of resemblance and difference between one and another, and to appreciate the deeper insight into the nature of the world which this type of investigation can give. For this reason it is unlikely that metaphysical conclusions

scientist, neither is he a logician, a philologist or a lexicographer, as some modern linguistic philosophers would have him to be. He is not assigning arbitrary or conventional meanings to words. It is more than a mere matter of convention that we use the term "same" in a number of distinct and non-univocal senses. We do so because we recognize—at first only obscurely and unreflectively—that there is a genuine analogy of application. Certain fundamental and objectively given aspects of, or relations between, things, are similar to, but not identical with, certain other fundamental aspects or relations. These remain, whether or not a particular language uses the same word or different words to express each of them.[1] The use of the same word draws attention to the existence of the similarities but it does not create them. The analogy of the terms is based upon the similarities of the things.

The analogies, as we have already seen, cannot be elucidated by the methods of natural science. To discover and appreciate them we do not need to make elaborate measurements or to devise new experiments. Ordinary everyday observation is a sufficient starting point. What is required is rather a deepening insight into the significance of facts which are already known and familiar. One of

[1] Different languages do in fact vary considerably in this respect.

WHAT has been said so far may suffice to give some idea of the subject-matter and method of approach of the metaphysician. The metaphysician is not a scientist. His function is to examine the meaning of the most fundamental and universal terms of rational discourse: terms such as "thing," "exist," "same," "different," "unity," "diversity," "substance," "cause," "contingent," "necessary." Some of these at least must be presupposed by all scientific discourse, but they cannot be investigated by scientific method since they cannot be given a univocal meaning, or fitted into the simplified logical *schema* which the scientist uses to express his laws. Metaphysics and science each has its own distinctive method; each is autonomous in its own field; both are required for an integrated and well-ordered scheme of knowledge. Each supplements the other and, apart from human weakness, there is no reason why they should ever come into conflict with each other.

On the other hand, if the metaphysician is not a

8. Conclusion: The Nature of Metaphysics

of which might have been avoided if their authors had had a clearer understanding of the scope of natural science and had realized that they were trespassing on fields where the scientist, not the metaphysician, must be the final arbiter.

ness, but that is hardly sufficient. Nobody is a mere scientist. Every scientist is a human being, and as such ought not to be wholly indifferent to the total significance of his work, nor to the ultimate ground from which its intelligibility is derived.

Equally, on the other hand, the metaphysician ought not to be uninterested in the work of the scientist. The metaphysical structure of the world, important and interesting as it is, is highly abstract and gives no hint of the variety and richness of order which is discoverable in the universe at a more concrete level. The metaphysical and scientific accounts of the world are both incomplete; each needs to be supplemented by the other and, eventually, integrated into a single whole. In addition, an appreciation of the scope of scientific method may protect the metaphysician from error even within his own sphere. Although, in general, the basic principles from which he starts can be discovered by reflection on ordinary experience, without the need for experiment or exact measurement, yet it is extremely difficult to know where genuine insight ends and unconscious prejudice begins. Aristotle and many of the medieval philosophers seem to have regarded it as metaphysically certain that the stars move naturally in circular paths at uniform velocity, and in this they were undoubtedly wrong. Other more recent examples of mistaken "insights" could be given, most

not a professional metaphysician who first realized the appropriateness of applying the term "same" (or its equivalent in other languages) to both properties and things, but ordinary people who recognized implicitly that there was an analogy of application, though without, we may suppose, adverting consciously to it.

It would be a mistake, therefore, to think of metaphysics as a remote and highly specialized subject which is of interest only to professional metaphysicians. We continually and inevitably use metaphysical terms and make metaphysical judgements, even though we normally do so without adverting to their significance. This is true also of the scientist in his laboratory, where he cannot help using terms such as "I," "it," "is," "same," "different," etc., and accepting principles such as that his memory is basically trustworthy, that things behave in much the same way when they are not being observed as when they are, or that the testimony of fellow scientists is generally reliable even when the recipient is not in a position to confirm it personally; all of which raise metaphysical problems. The question is not whether we shall use metaphysical principles or not, but whether we shall use them blindly or consciously, with some awareness of their import. No doubt the ordinary working scientist can get along well enough in his own job without having this aware-

This is the basis of the metaphysical proof of the existence of God.

Clearly it is a long step from the very generalized and apparently indefinite principle of intelligibility, which is derived from the universal analogy of being, to the concrete application implied in the proof of God's existence. Its justification is to be found, not primarily in the exercise of logical dialectic, but much more in a deepening insight into those fundamental analogies of being which enable us to bring one order or level of being into relation with another—logical with contingent sameness, accident with substance, properties with things, effects with causes, and finally, contingent with necessary being.

In saying this I do not wish to imply that the metaphysician has a monopoly of these ideas, or that he is the only one who can legitimately infer the existence of God from contingent things. The ordinary man has a natural and spontaneous aptitude to appreciate metaphysical truths, but until this has been clarified and certified by reflexion it will be more or less confused. It will be liable to be lost or distorted, especially if assailed by arguments to which no answer can be found. In general, the function of the metaphysician will be to clarify and deepen an insight which is already there in germ, not to discover something hitherto entirely unknown or unrecognized. It was certainly

tities external to himself; (b) the railway timetable, and the whole organization of men and machinery implicit in the fact that the timetable is sufficiently reliable to serve as a guide in planning one's life; (c) the business he has in town, the money he intends to earn, the home and family he wishes to support, and so on. These and many other entities must be brought into relation with John Smith in one way or another if his action is to be fully intelligible. They help, so to speak, to fill the gaps in our understanding of him, and are called "causes." A cause may be regarded in a wide sense as any entity which helps to render some other entity intelligible, or which is required in order to supplement a deficiency in the intelligibility of the other. And as there are many different ways in which this supplementation may be required, so there are distinct but analogous senses of the term "cause."

One particularly important application of this principle must be noted. The metaphysician, examining the idea of contingent being as such, will recognize in it a radical deficiency of intelligibility which of its nature cannot be remedied by any other contingent being but only by an eternal and necessary being. The ultimate ground of intelligibility of contingent being can only be an actually existing necessary being. Hence, if contingent being exists, so also must necessary being.

not absolutely nothing. Other terms, such as "being" or "entity," have similarly a universal application. Since they have some meaning whenever they are used, it follows that everything which is not simply nothing is intelligible; otherwise we could not recognize that the same term can aptly be applied to each. In the scholastic phraseology, it can be said that the principle of the intelligibility of being follows from the principle of the analogy of being. It does not follow that we ourselves can fully understand everything that is. But the fact that we can, however obscurely and confusedly, recognize that the terms "something," "entity," "being," have an analogous application which is absolutely universal, is a guarantee that all being lies within the possible range of intellect as such. There is nothing which is completely and intrinsically unintelligible.

The principle of intelligibility is capable of further development. We cannot understand a particular contingent being without having some understanding of many other such beings. For instance, we see John Smith walking to the station at 7.55 each morning. In order to fully understand this action, and therefore to understand John Smith who performs it, we should need to understand (a) his anatomical structure and physiological activity, and the dependence of these on food, water, air, warmth and other physical en-

CORRESPONDING to the analogy between the meanings of the word "same" is an analogy between the senses in which different entities can be said to have being, to be something, to be things. The chalk and its whiteness are not two things in the same sense—as if we could say, There are two things on this table: (a) the chalk, (b) the whiteness. And yet each is in some sense something—a being, an entity. Neither is simply nothing. The chalk is something; its whiteness is something; so is its distance from the electric-light switch, its resemblance to the piece of paper, its orientation in the north-south direction. But they are not all "somethings" in the same sense. Again we come up against the problem of analogy.

We can carry this line of investigation still further. Everything which is not plain blank nothing is in some sense something. And there is a genuine analogy between the uses of the term "something" when applied to any things which are

7. The Analogy of Being

himself, and clearly but rather less directly by his friends. It is certainly more than a linguistic convention. The sameness of John Smith's continuing personal identity is called substantial sameness; the differences which appear in him at various times are called accidental differences. A consideration of the ontological foundations of this usage leads to a recognition of the distinction between substance and accident. Analogously, we recognize a similar type of substantial sameness in animals and plants, and perhaps also, more obscurely, in inorganic things.

(2) Property sameness. The piece of chalk is white; so also is the piece of paper lying alongside it. Each has the "same" colour. This constitutes yet another use of the word "same." When we say the chalk and the paper have the same colour we are using the term in a different sense from that in which C_0 and C_5 are the same thing, but there is an analogy between the uses. An examination of the significance of this new sense leads to a recognition of the ontological distinction between things and properties.

in a rather different sense from the previous one. Previously we were able to say that C_0 and C_5 were, qualitatively, exactly the same in all respects. Now we can only say, not exactly the same; but nevertheless they are the same *thing*—the same piece of chalk. If I were to ask someone, "Is that the same piece that I put down five minutes ago?" it would be mere quibbling to reply, "No, it is a different piece" merely on the grounds that it was now a little warmer.

We can obtain a clearer insight into the distinction by reflecting on our own human existence. John Smith is continually changing in one way or another during his life, but he remains the same person throughout. And the sense in which he does so is a real and important one. If we had no more than the chalk to guide us, we might be tempted to regard it as a mere matter of convention: we could say that C_0 and C_5 are to be called the same if there is a spatio-temporal continuity between them, and if C_5 is not too different from C_0, but the precise point at which we shall say that C_5 is no longer the same thing as C_0 is determined by the customs of the language that we use. This may be true of the chalk, but it is certainly not true of human beings. The continuing personal identity of John Smith throughout his life, in spite of various changes, is something which is known clearly and directly by John Smith

So FAR, it has been possible to distinguish three analogous senses in which this term is used:

(1) The sense in which C_0 is the same as C_0; logically necessary sameness, or logical identity.

(2) The sense in which C_0 is the same thing as C_5; contingent sameness, or contingent self-identity.

(3) The sense in which an Eternal Being (actual or hypothetical) would be always the same; ontologically necessary sameness, or absolute self-identity.

Further consideration will shew that contingent sameness includes a number of different but still analogous senses, of which the most important must now be briefly noted.

(1) Substantial sameness. Suppose the chalk at 10.5 is not exactly the same in all respects as at 10.0 but is, say, slightly warmer. We should then say that in one sense it is the same piece of chalk at the two times; in another, C_0 is (slightly) different from C_5. We are now using the word "same"

6. Some Further Meanings of the Term "Same"

cation for this assertion later on. And if an Eternal Being exists, its existence must of course be possible. However, the point to be emphasized at the moment is that the idea of eternal existence, if not positively and completely intelligible to us, is not evidently absurd. The term "existence" may have two applications; one to eternal, the other to contingent being; and these two applications, although different, will be genuinely analogical. Once again, it is the business of the metaphysician to examine the analogy, and to pursue it as far as it can reasonably be taken.

Now the question arises: Is the aspect of successiveness, and therefore of incomplete unity, an absolute and ultimate character of existence as such, or is it a limitation or imperfection which might in principle be transcended? If the former, then the idea of an eternally existent being would be simply meaningless. If the latter, then it would at least have some significance; we could accept the possibility of an analogical extension of the notion of existence to include eternal existence. I do not think that any conclusive answer to this question can be given merely by examining the idea of eternal existence. We cannot transcend the limitations of our contingent nature sufficiently to be able to assure ourselves positively that it is possible.[1]

It does not follow that we cannot know at all whether an Eternal Being is possible. An examination of the nature of contingent being (which is much more accessible to our finite intellects) will suffice to establish the fact that such being requires for its existence the existence of an Eternal and Necessary Being as its ultimate Sufficient Reason. We shall consider, very briefly, the justifi-

[1] This is roughly the point at issue in the famous controversy over the ontological argument. St. Anselm held that we could arrive at a knowledge of God's existence merely by analyzing our idea of Infinite Being. The majority of scholastic philosophers follow St. Thomas in rejecting the validity of this argument.

bility—purely hypothetical at first—that there might be a being whose existence had a positive content and a positive unity so complete that there was no ground whatever of distinction between one part or moment of it and another. Such a being, if it existed, could not have come into existence nor could it cease to exist, since, where there is no distinction of parts or moments, there can be no earlier or later, no first or last. Existence of this sort is called "eternal," as having no beginning or end; and "necessary," since, of its nature, it is not the sort of existence which could cease to be.[1] The idea of eternal existence is admittedly a difficult one, since we cannot form any imaginative picture of it; but it is not evidently absurd. We can indeed arrive at some negative idea of it if we recognize that contingency arises from an incompleteness in the unity of our own existence. The different phases of our existence are not unified so perfectly that they could not, in principle, have been disrupted. Our being is never wholly present; when we are at one stage of our lives some stages have passed and others are still to come. Our existence is successive and always, in a sense, precarious. It comes to us, as it were, in driblets. Absolutely speaking, it might be broken off at any moment.

[1] It was defined by Boethius: "Interminabilis vitae tota simul et perfecta possessio"—"The totally simultaneous and perfect possession of unending life."

We say that a thing which continues to be the same thing for a certain period *exists* during that period. And the notion of existence may also have a variety of analogous senses. First we have the type of existence exemplified by the chalk. It exists at 10.0 and at 10.5, but it is not identically the same at both times. There is a ground of distinction by virtue of which we can refer to it at the two times as C_0 and C_5 respectively, and by virtue of which we can conceive the possibility of its existing at one time and not another, or not existing at all. This type of existence is called contingent. Contingent existence may be regarded as lying between two extremes. The first is the "point-event," regarded as a strictly instantaneous event —e.g., a piece of chalk existing at 10.0 only. This is, strictly, not existence at all. It represents the lower (extrinsic) boundary of contingent existence —the limiting case where the whole extent of the existence has disappeared.

At the other extreme we can conceive the possi-

5. The Problem of "Existence"